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Influence of Micro-algae Food on Growth of Larvae and Spat-set in Pearl Oyster *Pinctada fucata* (Gould)

S.DHARMARAJ and K. SHANMUGASUNDARAM

Central Marine Fisheries Research Institute, Tuticorin Research Centre, Tuticorin 628 001

Abstract

Optimum concentration of Isochrysis galbana as food was 4000-5000 cells per day per larva of *Pinctada fucata* (Gould). Acceptability of *Pavlova lutheri, Chromulina freiburgensis, Dicrateria* sp. and *Dunaliella* sp. was tested. The effect of algal food on growth and spatset determined. Increase in growth was recorded in Pavlova fed larvae than in I. galbana. Larvae fed with *Dunaliella* sp. did not survive beyond 13 days. *Isochrysis* and *Chromulina* at 1:1 ratio showed better growth. Larvae fed with *Dicrateria* showed poor growth and higher spatset when fed singly or in combination with *Isochrysis*. In 1:1:1:combination of *Isochryis : Pavlova : Chromulina* the larval growth was better than that in *Isochrysis : Pavlova : Dicrateria* combination.

Introduction

Isochrysis galbana was an ideal food for larvae and juveniles of bivalves (Loosanoff and Davis, 1963; Walne (1970). Wada (1973) reared the larvae of *P. fucata* at 10 cells of *Isochrysis* per µl for 12 days and at 20 cells /µl afterwards. Minaur (1969) fed the larvae of *Pinctada maxima* with different algal species at a density of 100cells/ul. *I. galbana* was supplied to the straight hinge stage of *P. fucata* at 80-120 cells/ul (Alagarswami *et al.*, 1983). Alagarswami *et al.*, (1989) fed the larvae of *Pinctada margaritifera* with Isochrysis at 5 cells /µl from day 2 and 10 cells /µl from day 5 onwards. The present work was undertaken to standardise optimum requirement of *I. galbana* to the larvae of *P. fucata* and to assess the relative value of other algae on growth and spatset.

Materials and Methods

Veligers of *P. fucata* were stocked at a density of 2 larvae/ml and fed with I. galbana at different concentrations *viz.* 1000, 2000, 4000, 5000, 6000 and 8000 cells / larva / day (2,4,8,10,12, and 16 cells / µl). The ration was doubled from umbo stage onwards. The growth of larvae at the above concentrations was monitored every 5 days. The spatset at each concentration was recorded.

Pavlova lutheri, Chromulina freiburgensis, Dicrateria sp. and *Dunaliella* sp. fed to the larvae of *P. fucata* individually. The growth of larvae and spatset in each alga were recorded. The combination of these alga with *I. galbana* and the combination of *Chromulina* and *Dicrateria* with *Pavlova* at 1:1 ratio were studied.

Three species combination of Isochrysis: *Chromulina: Dicrateria* and *Pavlova: Chromulina:* Dicrateria was tested at equal proportion.

Results and Discussion

Among the different algal concentrations 4000-5000 cells/larva/day (8-10 cells / l) gave better growth and high spatset. On day 23 the larvae attained 172.9 m in dorso-ventral measurement (DVM) when fed at 4000 cells/larva/day and 150.4 m when fed at 5000 cells/larva/day. The percentage spatset was 5.9 and 3.0 in the respective feeding rates (Table 1).

Pavlova fed larvae showed slightly higher growth than *I. galbana* fed ones and the percentage spatset was equal. Larvae fed with *Chromulina* and *Dicrateria* indicated lower growth than in I. galbana and Pavlova fed ones. The percentage spatset in Dicrateria feeding was high (9.5%). *Dunaliella* fed larvae survived only for 13 days. It was found unsuitable to the larvae of *P. fucata.*

When the larvae fed with *Isochrysis* and *Chromulina* at 1:1 combination better growth was obtained than in Isochrysis: *Pavlova* and *Isochrysis: Dicrateria* combination. 11.8% spatset was obtained in Isochrysis: Pavlova fed larvae. The growth in two species combination was higher than in single food (Table 2).

In three species combination *viz., Isochrysis: Pavlova: Chromulina* and *Isochrysis : Pavlova : Dicrateria* the growth and spatset were good in the former. The growth in three species feeding was lower than in single food (Table 2).

Determination of optimum requirement of food for a larva at its different stages of development was a prerequisite in larval rearing systems. The level of feeding varies at different stages. Minaur (1969) fed the larvae of *P. maxima* at 100 cells /µl. *I. galbana* was supplied to the larvae of *P. fucata* at a concentration of 80-120 cells/ul (Alagarswami *et al.*, 1983). In the present study I. galbana at 10 cells /µl upto umbo stage; at 20 cells / µl upto eyed stage and 30 cells /µl till spatset was found to be the optimum requirement for the larvae. Loosanoff and Davis (1963) stated that the higher algal concentration on bivalve larvae affects the regulatory capacity and also produces more external metabolites resulting in lower growth and spatset. A similar effect was observed in the present study where the growth and spatset were poor at higher algal concentration.

Table 1. Growth of *Pinctada fucata* larvae and spatset at different algal concentrations

Expt. No.	No. of cells/day /larva	Average size of larvae (m) Days				Spatset (n)	Spatset (%)
			8	13	18	23	
I	2000	62.6	86.4	90.7	126.5	148.7	-	2.0
	4000	62.6	89.5	98.0	133.0	146.8	-	1.9
	5000	62.6	92.7	103.6	137.4	150.4	-	5.9
	6000	62.6	83.8	91.3	111.1	145.0	-	2.3
II	1000	72.0	-	-	132.3	156.6	16	0.3
	2000	72.0	-	120.7	136.4	156.3	32	0.5
	4000	72.0	-	122.5	151.1	172.9	177	3.0
	6000	72.0	-	113.0	144.1	-	33	0.6
	8000	72.0	-	-	137.5	141.8	52	0.9

Table 2. Growth of *Pinctada fucata* larvae and spatset in one, two and three species concentrations.

Expt. No.	Name of algae	Average size of larvae (m)					Spatset (n)	Spatset (%)
			8	13	18	23		
I	Isochrysis	63.2	80.5	94.4	141.4	250.5	6578	6.58
	Pavlova	63.2	82.9	98.5	151.4	250.0	6589	6.59
	Dicrateria	63.2	69.5	69.8	died	-	-	-
	Chromulina	63.2	79.7	96.8	138.4	226.9	9913	9.25
	Dunaliella	63.2	69.5	69.8	ded	-	-	-
II	Isochrysis]							
	Pavlova]	62.3	85.1	110.3	142.8	246.8	11810	11.8
	1:1		*(81.7)	(96.5)	(146.4)	(250.3)		
	Isochrysis]							
	Dicrateria	62.3	76.3	96.2	156.1	259.3	9137	9.2
	1:1		(79.6)	(92.6)	(143.8)	(238.8)		
	Pavlova]							
	Chromulina]	62.3	72.9	86.7	106.1	153.3	4021	4.0
	1:1		(81.3)	(97.3)	(144.9)	(238.5)		
	Isochrysis	62.3	86.1	100.3	159.4	309.9	4015	4.0
	chromulina	(80.1)	(95.6)	(139.9)	(238.7)			
	Pavlova]							
	Dicrateria]	62.3	70.6	77.2	91.6	138.1	1242	1.2
	1:1		(80.8)	(94.6)	(148.8)	(238.5)		
III	Isochrysis]							
	Pavlova]	62.3	78.8	92.5	140.2	212.7	3963	4.0
	Chromulina]		(85.6)	(105.3)	(151.1)	(278.4)		
	1:1:1							
	Isochrysis]							
	Pavlova]	62.3	76.9	90.2	96.8	154.4	3190	3.2
	Dicrateria]		(80,7)	(103.3)	(149.5)	(253.1)		
	1:1:1							

* The numbers in parenthesis are the average value of the two/three single species of the respective algae in combination.

The larvae of *P. margaritifera* showed higher growth in Isochrysis feeding than in Pavlova (Alagarswami *et al.*, 1989). Wada (1973) demonstrated that *Monochrysis lutheri* (= *Pavlova lutheri*) promoted better growth in the larvae of *P. fucata*. Walne (1963) reported that *P. lutheri* gave slightly better growth than *I. galbana* in the larvae of *Ostrea edulis*. A similar result was obtained in the present study. The food value of Dicrateria inornata on the growth of larvae of *O. edulis* was poor than in *I. galbana* and *Chromulina pleiades* (Walne, 1956). Though a similar result was obtained in the present study, the percentage spatset was high when fed with Dicrateria singly or in combination. Saddar and Taub (1972) opined that the presence of relative amounts of essential nutrients in algal food may promote good growth and high spatset. Walne (1956) reported that the growth in the larvae of *O. edulis* was comparable with *I. galbana* and *Chromulina pleiades* feeding. In the larvae of *P. fucata* the growth was poor when fed with *Chromulina*.

Dunaliella euchlora and *Dunaliella* sp. found to induce better growth in the oyster larvae after 6 days of development (Loosanoff and Davis, 1963). *Dunaliella* sp. gave good growth in the larvae of *O. edulis* (Bruce *et al.*, 1939). The larvae of *P. fucata* neither metamorphosed nor survived beyond 13 days when fed with *Dunaliella* sp.

Loosanoff and Davis (1963) classified the algae as per their food value as *Monochrysis lutheri, I. galbana* and *Dicrateria* sp. in *Mercenaria mercenaria; M. lutheri, I. galbana, Chromulina* and *Dicrateria* in *Crassostrea virginica*. In our study the order was *P. lutheri, I. galbana, Dicrateria* sp. and *Chromulina freiburgensis*.

Ukeles (1969) reported better growth in combination of food (*Chlorococcum, I. galbana* and *M. lutheri*) than in single food. A mixture of *I. galbana, M. lutheri, Platymonas* sp. and *Dunaliella euchlora* induced rapid growth both in clam and oyster larvae than in single food (Davis and Quillard, 1958). Similarly in the present investigation *I. galbana* at 1:1 combination with *P. lutheri, Chromulina freiburgensis, Dicrateria* resulted in better growth than in single food.

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